

ELE HSM API Rev 1.0

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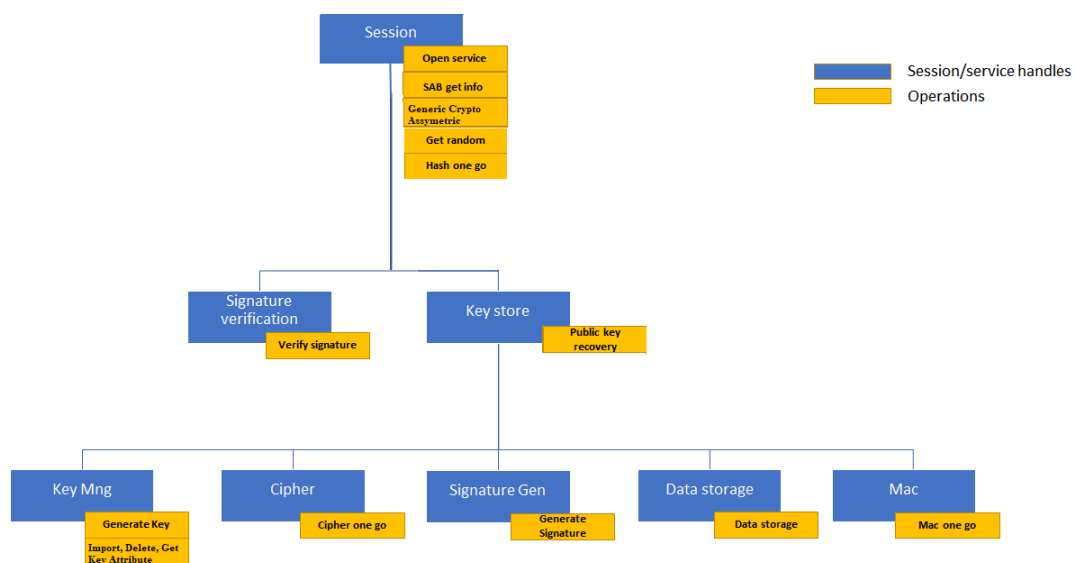
## 1 ELE HSM API

This document is a software referece description of the API provided by the i.MX8ULP, i.MX93 HSM solutions for ELE Platform.

## 2 Revision History

Revision	date	description
0.1	Apr 27 2023	Preliminary draft

### 3 General concepts related to the API



#### 3.1 Session

The API must be initialized by a potential requestor by opening a session.

The session establishes a route (MU, DomainID...) between the requestor and the HSM. When a session is opened, the HSM returns a handle identifying the session to the requestor.

#### 3.2 Service flow

For a given category of services which require service handle, the requestor is expected to open a service flow by invoking the appropriate HSM API.

The session handle, as well as the control data needed for the service flow, are provided as parameters of the call. Upon reception of the open request, the HSM allocates a context in which the session handle, as well as the provided control parameters are stored and return a handle identifying the service flow.

The context is preserved until the service flow, or the session, are closed by the user and it is used by the HSM to proceed with the sub-subsequent operations requested by the user on the service flow.

### 3.3 Example

```
/* Open a session: create a route between the user and the HSM */
hsm_open_session(&open_session_args, &session_hdl);

/* Open a key store - user is authenticated */
hsm_open_key_store_service(session_hdl, &open_svc_key_store_args, &key_store_hdl);

/* Open cipher service - it grants access to ciphering operations */
hsm_open_cipher_service(key_store_hdl, &open_svc_cipher_args, &cipher_hdl);

/* Perform ECB, CCB ... */
hsm_cipher_one_go (cipher_hdl, &op_cipher_one_go_args);
/* Perform authenticate and encryption algos: e.g GCM */
hsm_auth_enc (cipher_hdl, &op_auth_enc_args);
/* Perform hashing operations: e.g SHA */
hsm_hash_one_go (hash_hdl, &op_hash_one_go_args);

/* Close the session and all the related services */
hsm_close_session(session_hdl);
```

### 3.4 Key store

A key store can be created by specifying the CREATE flag in the hsm\_open\_key\_store\_service API. Please note that the created key store will be not stored in the NVM till a key is generated or imported specifying the "STRICT OPERATION" flag.

Only symmetric and private keys are stored into the key store. Public keys can be exported during the key pair generation operation or recalculated through the hsm\_pub\_key\_recovery API.

Secret keys cannot be exported under any circumstances, while they can be imported in encrypted form.

#### 3.4.1 Key management

Keys are divided in groups, keys belonging to the same group are written/read from the NVM as a monolithic block. Up to 3 key groups can be handled in the HSM local memory (those immediately available to perform crypto operations), while up to 1000 key groups can be handled in the external NVM and imported in the local memory as needed.

If the local memory is full (3 key groups already reside in the HSM local memory) and a new key group is needed by an incoming user request, the HSM swaps one of the local key group with the one needed by the user request. The user can control which key group must be kept in the local memory (cached) through the manage\_key\_group API lock/unlock mechanism.

As general concept, frequently used keys should be kept, when possible, in the same key group and locked in the local memory for performance optimization.

### 3.4.2 NVM writing

All the APIs creating a key store (open key store API) or modifying its content (key generation, key\_management, key derivation functions) provide a "STRICT OPERATION" flag. If the flag is set, the HSM exports the relevant key store blocks into the external NVM and increments (blows one bit) the OTP monotonic counter used as roll back protection. In case of key generation/derivation /update the "STRICT OPERATION" has effect only on the target key group.

Any update to the key store must be considered as effective only after an operation specifying flag "STRICT OPERATION" is acknowledged by the HSM. All the operations not specifying the "STRICT OPERATION" flags impact the HSM local memory only and will be lost in case of system reset

Due to the limited monotonic counter size, the user should, when possible, perform multiple update before setting the "STRICT OPERATION" flag(i.e. keys to be updated should be kept in the same key group).

Once the monotonic counter is completely blown a warning is returned on each key store export to the NVM to inform the user that the new updates are not roll-back protected.

## 3.5 Implementation specificities

HSM API with common features are supported on i.MX8ULP and i.MX93. The details of supported features per chip will be listed in the platform specificities.

## 4 Module Index

### 4.1 Modules

Here is a list of all modules:

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## 5 Module Documentation

### 5.1 Session

The API must be initialized by a potential requestor by opening a session. Once a session is closed all the associated service flows are closed by the HSM.

#### Data Structures

- struct [hsm\\_session\\_hdl\\_s](#)
- struct [hsm\\_service\\_hdl\\_s](#)
- struct [open\\_session\\_args\\_t](#)

#### Macros

- #define **HSM\_MAX\_SESSIONS** (8u)
- #define **HSM\_MAX\_SERVICES** (32u)
- #define [HSM\\_OPEN\\_SESSION\\_PRIORITY\\_LOW](#) (0x00U)  
*Low priority. default setting on platforms that doesn't support sessions priorities.*
- #define [HSM\\_OPEN\\_SESSION\\_PRIORITY\\_HIGH](#) (0x01U)  
*High Priority session.*
- #define [HSM\\_OPEN\\_SESSION\\_FIPS\\_MODE\\_MASK](#) (1u << 0)  
*Only FIPS certified operations authorized in this session.*
- #define [HSM\\_OPEN\\_SESSION\\_EXCLUSIVE\\_MASK](#) (1u << 1)  
*No other HSM session will be authorized on the same security enclave.*
- #define [HSM\\_OPEN\\_SESSION\\_LOW\\_LATENCY\\_MASK](#) (1u << 3)  
*Use a low latency HSM implementation.*
- #define [HSM\\_OPEN\\_SESSION\\_NO\\_KEY\\_STORE\\_MASK](#) (1u << 4)  
*No key store will be attached to this session. May provide better performances on some operation depending on the implementation. Usage of the session will be restricted to operations that doesn't involve secret keys (e.g. hash, signature verification, random generation).*
- #define [HSM\\_OPEN\\_SESSION\\_RESERVED\\_MASK](#) ((1u << 2) | (1u << 5) | (1u << 6) | (1u << 7))  
*Bits reserved for future use. Should be set to 0.*

#### Typedefs

- typedef uint32\_t [hsm\\_hdl\\_t](#)



## Functions

- [hsm\\_err\\_t hsm\\_open\\_session](#) ([open\\_session\\_args\\_t](#) \*args, [hsm\\_hdl\\_t](#) \*session\_hdl)
- [hsm\\_err\\_t hsm\\_close\\_session](#) ([hsm\\_hdl\\_t](#) session\_hdl)
- [struct hsm\\_session\\_hdl\\_s](#) \* [session\\_hdl\\_to\\_ptr](#) ([uint32\\_t](#) hdl)
- [struct hsm\\_service\\_hdl\\_s](#) \* [service\\_hdl\\_to\\_ptr](#) ([uint32\\_t](#) hdl)
- void [delete\\_session](#) ([struct hsm\\_session\\_hdl\\_s](#) \*s\_ptr)
- void [delete\\_service](#) ([struct hsm\\_service\\_hdl\\_s](#) \*s\_ptr)
- [struct hsm\\_session\\_hdl\\_s](#) \* [add\\_session](#) (void)
- [struct hsm\\_service\\_hdl\\_s](#) \* [add\\_service](#) ([struct hsm\\_session\\_hdl\\_s](#) \*session)

### 5.1.1 Detailed Description

The API must be initialized by a potential requestor by opening a session. Once a session is closed all the associated service flows are closed by the HSM.

### 5.1.2 Data Structure Documentation

#### Data Fields

<a href="#">struct plat_os_abs_hdl *</a>	<a href="#">phdl</a>	Pointer to OS device node.
<a href="#">uint32_t</a>	<a href="#">session_hdl</a>	Session handle.
<a href="#">uint32_t</a>	<a href="#">mu_type</a>	Session MU type.

#### 5.1.2.1 [struct hsm\\_session\\_hdl\\_s](#)

#### Data Fields

<a href="#">struct hsm_session_hdl_s *</a>	<a href="#">session</a>	Pointer to session handle.
<a href="#">uint32_t</a>	<a href="#">service_hdl</a>	Service handle.

#### 5.1.2.2 [struct hsm\\_service\\_hdl\\_s](#)

#### Data Fields

<a href="#">uint32_t</a>	<a href="#">session_hdl</a>	Session handle.
<a href="#">uint8_t</a>	<a href="#">session_priority</a>	Priority of the operations performed in this session.
<a href="#">uint8_t</a>	<a href="#">operating_mode</a>	Options for the session to be opened (bitfield).
<a href="#">uint8_t</a>	<a href="#">interrupt_idx</a>	Interrupt number of the MU used to indicate data availability.

#### 5.1.2.3 [struct open\\_session\\_args\\_t](#)

### 5.1.3 Function Documentation

**5.1.3.1 hsm\_open\_session()** `hsm_err_t hsm_open_session (`  
    `open_session_args_t * args,`  
    `hsm_hdl_t * session_hdl )`

**Parameters**

<i>args</i>	pointer to the structure containing the function arguments.
<i>session_hdl</i>	pointer to where the session handle must be written.

**Returns**

`error_code` error code.

**5.1.3.2 hsm\_close\_session()** `hsm_err_t hsm_close_session (`  
    `hsm_hdl_t session_hdl )`

Terminate a previously opened session. All the services opened under this session are closed as well

**Parameters**

<i>session_hdl</i>	pointer to the handle identifying the session to be closed.
--------------------	---

**Returns**

`error_code` error code.

## 5.2 Key management

### Data Structures

- struct [op\\_delete\\_key\\_args\\_t](#)
- struct [op\\_get\\_key\\_attr\\_args\\_t](#)
- struct [op\\_import\\_key\\_args\\_t](#)
- struct [kek\\_enc\\_key\\_hdr\\_t](#)
- struct [op\\_generate\\_key\\_ext\\_args\\_t](#)
- struct [op\\_generate\\_key\\_args\\_t](#)
- struct [open\\_svc\\_key\\_management\\_args\\_t](#)

### Macros

- #define [HSM\\_OP\\_DEL\\_KEY\\_FLAGS\\_STRICT\\_OPERATION](#) (([hsm\\_op\\_import\\_key\\_flags\\_t](#))(1u << 7))
- #define [HSM\\_OP\\_IMPORT\\_KEY\\_INPUT\\_E2GO\\_TLV](#) (([hsm\\_op\\_import\\_key\\_flags\\_t](#))(1u << 0))
- #define [HSM\\_OP\\_IMPORT\\_KEY\\_INPUT\\_SIGNED\\_MSG](#) (([hsm\\_op\\_import\\_key\\_flags\\_t](#))(0u << 0))
- *Bit 1-6: Reserved.*
- #define [HSM\\_OP\\_IMPORT\\_KEY\\_FLAGS\\_STRICT\\_OPERATION](#) (([hsm\\_op\\_import\\_key\\_flags\\_t](#))(1u << 7))
- #define [HSM\\_KEY\\_USAGE\\_EXPORT](#) (([hsm\\_key\\_usage\\_t](#)) (1u << 0))
- #define [HSM\\_KEY\\_USAGE\\_ENCRYPT](#) (([hsm\\_key\\_usage\\_t](#)) (1u << 8))
- #define [HSM\\_KEY\\_USAGE\\_DECRYPT](#) (([hsm\\_key\\_usage\\_t](#)) (1u << 9))
- #define [HSM\\_KEY\\_USAGE\\_SIGN\\_MSG](#) (([hsm\\_key\\_usage\\_t](#)) (1u << 10))
- #define [HSM\\_KEY\\_USAGE\\_VERIFY\\_MSG](#) (([hsm\\_key\\_usage\\_t](#)) (1u << 11))
- #define [HSM\\_KEY\\_USAGE\\_SIGN\\_HASH](#) (([hsm\\_key\\_usage\\_t](#)) (1u << 12))
- #define [HSM\\_KEY\\_USAGE\\_VERIFY\\_HASH](#) (([hsm\\_key\\_usage\\_t](#)) (1u << 13))
- #define [HSM\\_KEY\\_USAGE\\_DERIVE](#) (([hsm\\_key\\_usage\\_t](#)) (1u << 14))
- #define [HSM\\_KEY\\_INFO\\_PERSISTENT](#) (([hsm\\_key\\_info\\_t](#))(0u << 1))
- *< Persistent keys are stored in the external NVM.*
- #define [HSM\\_KEY\\_INFO\\_PERMANENT](#) (([hsm\\_key\\_info\\_t](#))(1u << 0))
- *Transient keys are deleted when the corresponding key store service flow is.*
- #define [HSM\\_KEY\\_INFO\\_TRANSIENT](#) (([hsm\\_key\\_info\\_t](#))(1u << 1))
- *When set, the key is considered as a master key.*
- #define [HSM\\_KEY\\_INFO\\_MASTER](#) (([hsm\\_key\\_info\\_t](#))(1u << 2))
- *When set, the key is considered as a key encryption key. KEK keys can only.*
- #define [HSM\\_KEY\\_INFO\\_KEK](#) (([hsm\\_key\\_info\\_t](#))(1u << 3))
- #define [FLAG\\_0](#)
- #define [HSM\\_OP\\_KEY\\_GENERATION\\_FLAGS\\_STRICT\\_OPERATION](#) (([hsm\\_op\\_key\\_gen\\_flags\\_t](#))(1u << 7))

### Typedefs

- typedef uint8\_t [hsm\\_op\\_delete\\_key\\_flags\\_t](#)
- typedef uint8\_t [hsm\\_op\\_import\\_key\\_flags\\_t](#)
- *Bit 0: Defines input configuration.*
- typedef uint32\_t [hsm\\_key\\_usage\\_t](#)
- typedef uint16\_t [hsm\\_key\\_group\\_t](#)
- typedef uint16\_t [hsm\\_key\\_info\\_t](#)
- typedef uint8\_t [hsm\\_op\\_key\\_gen\\_flags\\_t](#)
- *Reserved Bits 0 - 6.*
- typedef uint8\_t [hsm\\_svc\\_key\\_management\\_flags\\_t](#)

## Enumerations

- enum `hsm_storage_loc_t` { `HSM_SE_KEY_STORAGE` = 0x00000000 }  
*Indicating the key location indicator.*
- enum `hsm_storage_persist_lvl_t` {  
`HSM_VOLATILE_STORAGE` = 0x0,  
`HSM_PERSISTENT_STORAGE` = 0x1,  
`HSM_PERMANENT_STORAGE` = 0xFF }  
*Indicating the key persistent level indicator.*
- enum `hsm_key_lifetime_t` {  
`HSM_SE_KEY_STORAGE_VOLATILE` = `HSM_SE_KEY_STORAGE` | `HSM_VOLATILE_STORAGE`,  
`HSM_SE_KEY_STORAGE_PERSISTENT` = `HSM_SE_KEY_STORAGE` | `HSM_PERSISTENT_STORAGE`,  
`HSM_SE_KEY_STORAGE_PERS_PERM` = `HSM_SE_KEY_STORAGE` | `HSM_PERMANENT_STORAGE`  
}
  
*Indicating the key lifetime.*
- enum `hsm_pubkey_type_t` {  
`HSM_PUBKEY_TYPE_RSA` = 0x4001,  
`HSM_PUBKEY_TYPE_ECC_BP_R1` = 0x4130,  
`HSM_PUBKEY_TYPE_ECC_NIST` = 0x4112,  
`HSM_PUBKEY_TYPE_ECC_BP_T1` = 0xC180 }  
*Indicating the public key type.*
- enum `hsm_key_type_t` {  
`HSM_KEY_TYPE_HMAC` = 0x1100,  
`HSM_KEY_TYPE_AES` = 0x2400,  
`HSM_KEY_TYPE_SM4` = 0x2405,  
`HSM_KEY_TYPE_RSA` = 0x7001,  
`HSM_KEY_TYPE_ECC_BP_R1` = 0x7130,  
`HSM_KEY_TYPE_ECC_NIST` = 0x7112 }  
*Indicating the key type.*
- enum `hsm_bit_key_sz_t` {  
`HSM_KEY_SIZE_HMAC_224` = 224,  
`HSM_KEY_SIZE_HMAC_256` = 256,  
`HSM_KEY_SIZE_HMAC_384` = 384,  
`HSM_KEY_SIZE_HMAC_512` = 512,  
`HSM_KEY_SIZE_AES_128` = 128,  
`HSM_KEY_SIZE_AES_192` = 192,  
`HSM_KEY_SIZE_AES_256` = 256,  
`HSM_KEY_SIZE_SM4_128` = 128,  
`HSM_KEY_SIZE_RSA_2048` = 2048,  
`HSM_KEY_SIZE_RSA_3072` = 3072,  
`HSM_KEY_SIZE_RSA_4096` = 4096,  
`HSM_KEY_SIZE_ECC_BP_R1_224` = 224,  
`HSM_KEY_SIZE_ECC_BP_R1_256` = 256,  
`HSM_KEY_SIZE_ECC_BP_R1_320` = 320,  
`HSM_KEY_SIZE_ECC_BP_R1_384` = 384,  
`HSM_KEY_SIZE_ECC_BP_R1_512` = 512,  
`HSM_KEY_SIZE_ECC_NIST_224` = 224,  
`HSM_KEY_SIZE_ECC_NIST_256` = 256,  
`HSM_KEY_SIZE_ECC_NIST_384` = 384,  
`HSM_KEY_SIZE_ECC_NIST_521` = 521,  
`HSM_KEY_SIZE_ECC_BP_T1_224` = 224,  
`HSM_KEY_SIZE_ECC_BP_T1_256` = 256,  
`HSM_KEY_SIZE_ECC_BP_T1_320` = 320,  
`HSM_KEY_SIZE_ECC_BP_T1_384` = 384 }  
*Indicating the key security size in bits.*

```

• enum hsm_permitted_algo_t {
    PERMITTED_ALGO_SHA224 = ALGO_HASH_SHA224,
    PERMITTED_ALGO_SHA256 = ALGO_HASH_SHA256,
    PERMITTED_ALGO_SHA384 = ALGO_HASH_SHA384,
    PERMITTED_ALGO_SHA512 = ALGO_HASH_SHA512,
    PERMITTED_ALGO_SM3 = ALGO_HASH_SM3,
    PERMITTED_ALGO_HMAC_SHA256 = ALGO_HMAC_SHA256,
    PERMITTED_ALGO_HMAC_SHA384 = ALGO_HMAC_SHA384,
    PERMITTED_ALGO_CMAC = ALGO_CMAC,
    PERMITTED_ALGO_CTR = ALGO_CIPHER_CTR,
    PERMITTED_ALGO_CFB = ALGO_CIPHER_CFB,
    PERMITTED_ALGO_OFB = ALGO_CIPHER_OFB,
    PERMITTED_ALGO_ECB_NO_PADDING = ALGO_CIPHER_ECB_NO_PAD,
    PERMITTED_ALGO_CBC_NO_PADDING = ALGO_CIPHER_CBC_NO_PAD,
    PERMITTED_ALGO_CCM = ALGO_CCM,
    PERMITTED_ALGO_GCM = ALGO_GCM,
    PERMITTED_ALGO_RSA_PKCS1_V15_SHA224 = ALGO_RSA_PKCS1_V15_SHA224,
    PERMITTED_ALGO_RSA_PKCS1_V15_SHA256 = ALGO_RSA_PKCS1_V15_SHA256,
    PERMITTED_ALGO_RSA_PKCS1_V15_SHA384 = ALGO_RSA_PKCS1_V15_SHA384,
    PERMITTED_ALGO_RSA_PKCS1_V15_SHA512 = ALGO_RSA_PKCS1_V15_SHA512,
    PERMITTED_ALGO_RSA_PKCS1_PSS_MGF1_SHA224 = ALGO_RSA_PKCS1_PSS_MGF1_SHA224,
    PERMITTED_ALGO_RSA_PKCS1_PSS_MGF1_SHA256 = ALGO_RSA_PKCS1_PSS_MGF1_SHA256,
    PERMITTED_ALGO_RSA_PKCS1_PSS_MGF1_SHA384 = ALGO_RSA_PKCS1_PSS_MGF1_SHA384,
    PERMITTED_ALGO_RSA_PKCS1_PSS_MGF1_SHA512 = ALGO_RSA_PKCS1_PSS_MGF1_SHA512,
    PERMITTED_ALGO_ECDSA_SHA224 = ALGO_ECDSA_SHA224,
    PERMITTED_ALGO_ECDSA_SHA256 = ALGO_ECDSA_SHA256,
    PERMITTED_ALGO_ECDSA_SHA384 = ALGO_ECDSA_SHA384,
    PERMITTED_ALGO_ECDSA_SHA512 = ALGO_ECDSA_SHA512,
    PERMITTED_ALGO_HMAC_KDF_SHA256 = ALGO_HMAC_KDF_SHA256,
    PERMITTED_ALGO_ALL_CIPHER = ALGO_CIPHER_ALL,
    PERMITTED_ALGO_ALL_AEAD = ALGO_ALL_AEAD,
    PERMITTED_ALGO_OTH_KEY_CBC = ALGO_CIPHER_KEY_CBC }

• enum hsm_key_lifecycle_t {
    HSM_KEY_LIFECYCLE_OPEN = 0x1,
    HSM_KEY_LIFECYCLE_CLOSED = 0x2,
    HSM_KEY_LIFECYCLE_CLOSED_LOCKED = 0x4 }

```

## Functions

- [hsm\\_err\\_t hsm\\_delete\\_key](#) (hsm\_hdl\_t key\_management\_hdl, op\_delete\_key\_args\_t \*args)
- [hsm\\_err\\_t hsm\\_get\\_key\\_attr](#) (hsm\_hdl\_t key\_management\_hdl, op\_get\_key\_attr\_args\_t \*args)
- [hsm\\_err\\_t hsm\\_import\\_key](#) (hsm\_hdl\_t key\_management\_hdl, op\_import\_key\_args\_t \*args)
- [hsm\\_err\\_t hsm\\_generate\\_key\\_ext](#) (hsm\_hdl\_t key\_management\_hdl, op\_generate\_key\_ext\_args\_t \*args)
- [hsm\\_err\\_t hsm\\_generate\\_key](#) (hsm\_hdl\_t key\_management\_hdl, op\_generate\_key\_args\_t \*args)
- [hsm\\_err\\_t hsm\\_open\\_key\\_management\\_service](#) (hsm\_hdl\_t key\_store\_hdl, open\_svc\_key\_management\_args\_t \*args, hsm\_hdl\_t \*key\_management\_hdl)
- [hsm\\_err\\_t hsm\\_close\\_key\\_management\\_service](#) (hsm\_hdl\_t key\_management\_hdl)

### 5.2.1 Detailed Description

### 5.2.2 Data Structure Documentation

#### Data Fields

uint32_t	key_identifier	identifier of the key to be used for the operation.
hsm_op_delete_key_flags_t	flags	bitmap specifying the operation properties.

## 5.2.2.1 struct op\_delete\_key\_args\_t

## Data Fields

uint32_t	key_identifier	identifier of the key to be used for the operation.
hsm_key_type_t	key_type	indicates which type of key must be generated.
hsm_bit_key_sz_t	bit_key_sz	
hsm_key_lifetime_t	key_lifetime	
hsm_key_usage_t	key_usage	
hsm_permitted_algo_t	permitted_algo	
hsm_key_lifecycle_t	lifecycle	

## 5.2.2.2 struct op\_get\_key\_attr\_args\_t

## Data Fields

uint32_t	key_identifier	Identifier of the KEK used to encrypt the key to be imported (Ignored if KEK is not used as set as part of "flags" field).
uint8_t *	input_lsb_addr	Address in the requester space where: <ul style="list-style-type: none"> <li>• EdgeLock 2GO TLV can be found.</li> <li>• Ignore this field if not E2GO_TLV.</li> </ul>
uint32_t	input_size	Size in bytes of: <ul style="list-style-type: none"> <li>• EdgeLock 2GO TLV can be found.</li> <li>• Ignore this field if not E2GO_TLV.</li> </ul>
hsm_op_import_key_flags_t	flags	bitmap specifying the operation properties.

## 5.2.2.3 struct op\_import\_key\_args\_t

## Data Fields

uint8_t	iv[IV_LENGTH]	
uint8_t *	key	
uint32_t	tag	

## 5.2.2.4 struct kek\_enc\_key\_hdr\_t

## Data Fields

uint32_t *	key_identifier	pointer to the identifier of the key to be used for the operation In case of create operation the new key identifier will be stored in this location
uint16_t	out_size	length in bytes of the generated key It must be 0 in case of symmetric keys

## Data Fields

<a href="#">hsm_op_key_gen_flags_t</a>	flags	bitmap specifying the operation properties
<a href="#">hsm_key_type_t</a>	key_type	indicates which type of key must be generated
hsm_key_group_t	key_group	Key group of the generated key. It must be a value in the range 0-1023. Keys belonging to the same group can be cached in the HSM local memory through the <a href="#">hsm_manage_key_group</a> API
hsm_key_info_t	key_info	bitmap specifying the properties of the key
uint8_t *	out_key	pointer to the output area where the generated public key must be written.
uint8_t	min_mac_len	min mac length in bits to be set for this key, value 0 indicates use default (see <a href="#">op_mac_one_go_args_t</a> for more details). Only accepted for keys that can be used for mac operations, must not be larger than maximum mac size that can be performed with the key. When in FIPS approved mode values < 32 bits are not allowed.
uint8_t	reserved[3]	It must be 0.

## 5.2.2.5 struct op\_generate\_key\_ext\_args\_t

## Data Fields

uint32_t *	key_identifier	pointer to the identifier of the key to be used for the operation. In case of create operation the new key identifier will be stored in this location.
uint16_t	out_size	length in bytes of the generated key. It must be 0 in case of symmetric keys.
<a href="#">hsm_op_key_gen_flags_t</a>	flags	bitmap specifying the operation properties.
<a href="#">hsm_key_type_t</a>	key_type	indicates which type of key must be generated.
hsm_key_group_t	key_group	Key group of the generated key. It must be a value in the range 0-1023. Keys belonging to the same group can be cached in the HSM local memory through the <a href="#">hsm_manage_key_group</a> API.
uint8_t *	out_key	pointer to the output area where the generated public key must be written.
<a href="#">hsm_bit_key_sz_t</a>	bit_key_sz	
hsm_key_lifecycle_t	key_lifecycle	defines the device lifecycle in which the key is usable. If it is set to 0, current device lifecycle is used.
<a href="#">hsm_key_lifetime_t</a>	key_lifetime	
hsm_key_usage_t	key_usage	
hsm_permitted_algo_t	permitted_algo	

## 5.2.2.6 struct op\_generate\_key\_args\_t

## Data Fields

hsm_hdl_t	key_management_hdl	handle identifying the key management service flow
hsm_svc_key_management_flags_t	flags	bitmap specifying the services properties.

### 5.2.2.7 struct open\_svc\_key\_management\_args\_t

## 5.2.3 Macro Definition Documentation

**5.2.3.1 HSM\_OP\_IMPORT\_KEY\_INPUT\_SIGNED\_MSG** #define HSM\_OP\_IMPORT\_KEY\_INPUT\_SIGNED\_MSG  
SG ((hsm\_op\_import\_key\_flags\_t) (0u << 0))

Bit 1-6: Reserved.

Bit 7: Strict: Request completed - New key written to NVM with updated MC.

**5.2.3.2 HSM\_KEY\_INFO\_PERSISTENT** #define HSM\_KEY\_INFO\_PERSISTENT ((hsm\_key\_info\_t) (0u << 1))

< Persistent keys are stored in the external NVM.

When set, the key is permanent (write locked). Once created, it will not

**5.2.3.3 FLAG** #define FLAG 0

structure defining

**5.2.3.4 HSM\_OP\_KEY\_GENERATION\_FLAGS\_STRICT\_OPERATION** #define HSM\_OP\_KEY\_GENERATION\_FLAGS\_STRICT\_OPERATION ((hsm\_op\_key\_gen\_flags\_t) (1u << 7))

< The request is completed only when the new key has been written in the NVM. This applicable for persistent key only.

## 5.2.4 Function Documentation

**5.2.4.1 hsm\_delete\_key()** hsm\_err\_t hsm\_delete\_key (  
hsm\_hdl\_t key\_management\_hdl,  
op\_delete\_key\_args\_t \* args )

This command is designed to perform the following operations:

- delete an existing key

### Parameters

<i>key_importment_hdl</i>	handle identifying the key management service flow.
<i>args</i>	pointer to the structure containing the function arguments.



**Returns**

error code Bit 0-6: Reserved. Bit 7: Strict: Request completed - New key written to NVM with updated MC.

```
5.2.4.2 hsm_get_key_attr() hsm_err_t hsm_get_key_attr (
    hsm_hdl_t key_management_hdl,
    op_get_key_attr_args_t * args )
```

This command is designed to perform the following operations:

- get attributes of an existing key

**Parameters**

<i>key_importment_hdl</i>	handle identifying the key management service flow.
<i>args</i>	pointer to the structure containing the function arguments.

**Returns**

error code

```
5.2.4.3 hsm_generate_key_ext() hsm_err_t hsm_generate_key_ext (
    hsm_hdl_t key_management_hdl,
    op_generate_key_ext_args_t * args )
```

Generate a key or a key pair with extended settings. Basic operation is identical to `hsm_generate_key`, but accepts additional settings. Currently the `min_mac_len` is the only additional setting accepted.

**Parameters**

<i>key_management_hdl</i>	handle identifying the key management service flow.
<i>args</i>	pointer to the structure containing the function arguments.

**Returns**

error code

```
5.2.4.4 hsm_generate_key() hsm_err_t hsm_generate_key (
    hsm_hdl_t key_management_hdl,
    op_generate_key_args_t * args )
```

Generate a key or a key pair. Only the confidential keys (symmetric and private keys) are stored in the internal key store, while the non-confidential keys (public key) are exported.

The generated key can be stored using a new or existing key identifier with the restriction that an existing key can be replaced only by a key of the same type.

**Parameters**

<i>key_management_hdl</i>	handle identifying the key management service flow.
<i>args</i>	pointer to the structure containing the function arguments.

**Returns**

error code

```
5.2.4.5 hsm_open_key_management_service() hsm_err_t hsm_open_key_management_service (
    hsm_hdl_t key_store_hdl,
    open_svc_key_management_args_t * args,
    hsm_hdl_t * key_management_hdl )
```

Open a key management service flow

User must open this service flow in order to perform operation on the key store keys (generate, update, delete)

**Parameters**

<i>key_store_hdl</i>	handle identifying the key store service flow.
<i>args</i>	pointer to the structure containing the function arguments.
<i>key_management_hdl</i>	pointer to where the key management service flow handle must be written.

**Returns**

*error\_code* error code.

```
5.2.4.6 hsm_close_key_management_service() hsm_err_t hsm_close_key_management_service (
    hsm_hdl_t key_management_hdl )
```

Terminate a previously opened key management service flow

**Parameters**

<i>key_management_hdl</i>	handle identifying the key management service flow.
---------------------------	---

**Returns**

error code

## 5.3 Ciphering

### Data Structures

- struct [op\\_auth\\_enc\\_args\\_t](#)
- struct [open\\_svc\\_cipher\\_args\\_t](#)
- struct [op\\_cipher\\_one\\_go\\_args\\_t](#)

### Macros

- `#define HSM_AUTH_ENC_FLAGS_DECRYPT ((hsm_op_auth_enc_flags_t)(0u << 0))`
- `#define HSM_AUTH_ENC_FLAGS_ENCRYPT ((hsm_op_auth_enc_flags_t)(1u << 0))`  
*Full IV is internally generated (only relevant for encryption)*
- `#define HSM_AUTH_ENC_FLAGS_GENERATE_FULL_IV ((hsm_op_auth_enc_flags_t)(1u << 1))`  
*User supplies 4 bytes of the IV (fixed part), the other bytes are.*
- `#define HSM_AUTH_ENC_FLAGS_GENERATE_COUNTER_IV ((hsm_op_auth_enc_flags_t)(1u << 2))`
- `#define HSM_CIPHER_ONE_GO_FLAGS_DECRYPT ((hsm_op_cipher_one_go_flags_t)(0u << 0))`
- `#define HSM_CIPHER_ONE_GO_FLAGS_ENCRYPT ((hsm_op_cipher_one_go_flags_t)(1u << 0))`

### Typedefs

- `typedef uint8_t hsm_op_auth_enc_flags_t`
- `typedef uint8_t hsm_svc_cipher_flags_t`
- `typedef uint8_t hsm_op_cipher_one_go_flags_t`

### Enumerations

- `enum hsm_op_auth_enc_algo_t { HSM_AEAD_ALGO_CCM = ALGO_CCM }`
- `enum hsm_op_cipher_one_go_algo_t {  
HSM_CIPHER_ONE_GO_ALGO_CTR = ALGO_CIPHER_CTR,  
HSM_CIPHER_ONE_GO_ALGO_CFB = ALGO_CIPHER_CFB,  
HSM_CIPHER_ONE_GO_ALGO_OFB = ALGO_CIPHER_OFB,  
HSM_CIPHER_ONE_GO_ALGO_ECB = ALGO_CIPHER_ECB_NO_PAD,  
HSM_CIPHER_ONE_GO_ALGO_CBC = ALGO_CIPHER_CBC_NO_PAD }`

### Functions

- `hsm_err_t hsm_do_cipher (hsm_hdl_t cipher_hdl, op_cipher_one_go_args_t *cipher_one_go)`
- `hsm_err_t hsm_auth_enc (hsm_hdl_t cipher_hdl, op_auth_enc_args_t *args)`
- `hsm_err_t hsm_open_cipher_service (hsm_hdl_t key_store_hdl, open_svc_cipher_args_t *args, hsm_hdl_t *cipher_hdl)`
- `hsm_err_t hsm_cipher_one_go (hsm_hdl_t cipher_hdl, op_cipher_one_go_args_t *args)`
- `hsm_err_t hsm_close_cipher_service (hsm_hdl_t cipher_hdl)`

#### 5.3.1 Detailed Description

#### 5.3.2 Data Structure Documentation

## Data Fields

uint32_t	key_identifier	< identifier of the key to be used for the operation pointer to the user supplied part of initialization vector or nonce,
uint8_t *	iv	length in bytes of the fixed part of the initialization vector for
uint16_t	iv_size	pointer to the additional authentication data
uint8_t *	aad	length in bytes of the additional authentication data
uint16_t	aad_size	algorithm to be used for the operation
<a href="#">hsm_op_auth_enc_algo_t</a>	ae_algo	bitmap specifying the operation attributes
hsm_op_auth_enc_flags_t	flags	pointer to the input area plaintext for encryption
uint8_t *	input	pointer to the output area Ciphertext + Tag (16 bytes)
uint8_t *	output	length in bytes of the input
uint32_t	input_size	length in bytes of the output
uint32_t	output_size	

## 5.3.2.1 struct op\_auth\_enc\_args\_t

## Data Fields

hsm_hdl_t	cipher_hdl	handle identifying the cipher service flow
hsm_svc_cipher_flags_t	flags	bitmap specifying the services properties
uint8_t	reserved[3]	

## 5.3.2.2 struct open\_svc\_cipher\_args\_t

## Data Fields

uint32_t	key_identifier	< identifier of the key to be used for the operation pointer to the initialization vector (nonce in case of AES CCM)
uint8_t *	iv	length in bytes of the initialization vector.
uint16_t	iv_size	bitmap specifying the services properties.
hsm_svc_cipher_flags_t	svc_flags	bitmap specifying the operation attributes
hsm_op_cipher_one_go_flags_t	flags	algorithm to be used for the operation
<a href="#">hsm_op_cipher_one_go_algo_t</a>	cipher_algo	pointer to the input area:
uint8_t *	input	pointer to the output area:
uint8_t *	output	length in bytes of the input.
uint32_t	input_size	length in bytes of the output
uint32_t	output_size	

## 5.3.2.3 struct op\_cipher\_one\_go\_args\_t

## 5.3.3 Enumeration Type Documentation

### 5.3.3.1 hsm\_op\_auth\_enc\_algo\_t enum hsm\_op\_auth\_enc\_algo\_t

Enumerator

HSM_AEAD_ALGO_CCM	CCM (AES CCM)
-------------------	---------------

### 5.3.3.2 hsm\_op\_cipher\_one\_go\_algo\_t enum hsm\_op\_cipher\_one\_go\_algo\_t

Enumerator

HSM_CIPHER_ONE_GO_ALGO_CTR	CTR (AES supported). CFB (AES supported).
HSM_CIPHER_ONE_GO_ALGO_CFB	OFB (AES supported).
HSM_CIPHER_ONE_GO_ALGO_OFB	ECB no padding (AES, SM4 supported).
HSM_CIPHER_ONE_GO_ALGO_ECB	CBC no padding (AES, SM4 supported).

## 5.3.4 Function Documentation

### 5.3.4.1 hsm\_do\_cipher() hsm\_err\_t hsm\_do\_cipher ( hsm\_hdl\_t cipher\_hdl, op\_cipher\_one\_go\_args\_t \* cipher\_one\_go )

Secondary API to perform ciphering operation

This API does the following:

1. Open an Cipher Service Flow
2. Perform ciphering operation
3. Terminate a previously opened cipher service flow  
User can call this function only after having opened a cipher service flow.

Parameters

<i>key_store_hdl</i>	handle identifying the cipher service flow.
<i>args</i>	pointer to the structure containing the function arguments.

Returns

error code

```

5.3.4.2 hsm_auth_enc() hsm_err_t hsm_auth_enc (
    hsm_hdl_t cipher_hdl,
    op_auth_enc_args_t * args )

```

Perform authenticated encryption operation

User can call this function only after having opened a cipher service flow

For decryption operations, the full IV is supplied by the caller via the iv and iv\_size parameters. HSM\_AUTH\_ENC\_FLAGS\_GENERATE\_FULL\_IV and HSM\_AUTH\_ENC\_FLAGS\_GENERATE\_COUNTER\_IV flags are ignored. For encryption operations, either HSM\_AUTH\_ENC\_FLAGS\_GENERATE\_FULL\_IV or HSM\_AUTH\_ENC\_FLAGS\_GENERATE\_COUNTER\_IV must be set when calling this function:

- When HSM\_AUTH\_ENC\_FLAGS\_GENERATE\_FULL\_IV is set, the full IV is internally generated, iv and iv\_size must be set to 0
- When HSM\_AUTH\_ENC\_FLAGS\_GENERATE\_COUNTER\_IV is set, the user supplies a 4 byte fixed part of the IV. The other IV bytes are internally generated

#### Parameters

<i>cipher_hdl</i>	handle identifying the cipher service flow.
<i>args</i>	pointer to the structure containing the function arguments.

#### Returns

error code

```

5.3.4.3 hsm_open_cipher_service() hsm_err_t hsm_open_cipher_service (
    hsm_hdl_t key_store_hdl,
    open_svc_cipher_args_t * args,
    hsm_hdl_t * cipher_hdl )

```

- Open a cipher service flow.
- User can call this function only after having opened a key-store service flow.
- User must open this service in order to perform cipher operation.

#### Parameters

<i>key_store_hdl</i>	handle identifying the key store service flow.
<i>args</i>	pointer to the structure containing the function arguments.
<i>cipher_hdl</i>	pointer to where the cipher service flow handle must be written.

#### Returns

error code

**5.3.4.4 hsm\_cipher\_one\_go()** `hsm_err_t hsm_cipher_one_go (`  
    `hsm_hdl_t cipher_hdl,`  
    `op_cipher_one_go_args_t * args )`

Perform cipherring operation

User can call this function only after having opened a cipher service flow

**Parameters**

<i><code>cipher_hdl</code></i>	handle identifying the cipher service flow.
<i><code>args</code></i>	pointer to the structure containing the function arguments.

**Returns**

error code

**5.3.4.5 hsm\_close\_cipher\_service()** `hsm_err_t hsm_close_cipher_service (`  
    `hsm_hdl_t cipher_hdl )`

Terminate a previously opened cipher service flow

**Parameters**

<i><code>cipher_hdl</code></i>	pointer to handle identifying the cipher service flow to be closed.
--------------------------------	---

**Returns**

error code



## 5.4 Signature generation

### Data Structures

- struct [open\\_svc\\_sign\\_gen\\_args\\_t](#)
- struct [op\\_generate\\_sign\\_args\\_t](#)
- struct [op\\_prepare\\_sign\\_args\\_t](#)

### Macros

- #define [HSM\\_OP\\_GENERATE\\_SIGN\\_FLAGS\\_INPUT\\_DIGEST](#) ((hsm\_op\_generate\_sign\_flags\_t)(0u << 0))
- #define [HSM\\_OP\\_GENERATE\\_SIGN\\_FLAGS\\_INPUT\\_MESSAGE](#) ((hsm\_op\_generate\_sign\_flags\_t)(1u << 0))
- #define [HSM\\_OP\\_PREPARE\\_SIGN\\_INPUT\\_DIGEST](#) ((hsm\_op\_prepare\_signature\_flags\_t)(0u << 0))
- #define [HSM\\_OP\\_PREPARE\\_SIGN\\_INPUT\\_MESSAGE](#) ((hsm\_op\_prepare\_signature\_flags\_t)(1u << 0))
- #define [HSM\\_OP\\_PREPARE\\_SIGN\\_COMPRESSED\\_POINT](#) ((hsm\_op\_prepare\_signature\_flags\_t)(1u << 1))

### Typedefs

- typedef uint8\_t [hsm\\_op\\_generate\\_sign\\_flags\\_t](#)
- typedef uint8\_t [hsm\\_op\\_prepare\\_signature\\_flags\\_t](#)

### Enumerations

- enum [hsm\\_signature\\_scheme\\_id\\_t](#) {  
[HSM\\_SIGNATURE\\_SCHEME\\_RSA\\_PKCS1\\_V15\\_SHA224](#) = 0x06000208,  
[HSM\\_SIGNATURE\\_SCHEME\\_RSA\\_PKCS1\\_V15\\_SHA256](#) = 0x06000209,  
[HSM\\_SIGNATURE\\_SCHEME\\_RSA\\_PKCS1\\_V15\\_SHA384](#) = 0x0600020A,  
[HSM\\_SIGNATURE\\_SCHEME\\_RSA\\_PKCS1\\_V15\\_SHA512](#) = 0x0600020B,  
[HSM\\_SIGNATURE\\_SCHEME\\_RSA\\_PKCS1\\_V15\\_ANY\\_HASH](#) = 0x060002FF,  
[HSM\\_SIGNATURE\\_SCHEME\\_RSA\\_PKCS1\\_PSS\\_MGF1\\_SHA224](#) = 0x06000308,  
[HSM\\_SIGNATURE\\_SCHEME\\_RSA\\_PKCS1\\_PSS\\_MGF1\\_SHA256](#) = 0x06000309,  
[HSM\\_SIGNATURE\\_SCHEME\\_RSA\\_PKCS1\\_PSS\\_MGF1\\_SHA384](#) = 0x0600030A,  
[HSM\\_SIGNATURE\\_SCHEME\\_RSA\\_PKCS1\\_PSS\\_MGF1\\_SHA512](#) = 0x0600030B,  
[HSM\\_SIGNATURE\\_SCHEME\\_RSA\\_PKCS1\\_PSS\\_MGF1\\_ANY\\_HASH](#) = 0x060003FF,  
[HSM\\_SIGNATURE\\_SCHEME\\_ECDSA\\_ANY](#) = 0x06000600,  
[HSM\\_SIGNATURE\\_SCHEME\\_ECDSA\\_SHA224](#) = 0x06000608,  
[HSM\\_SIGNATURE\\_SCHEME\\_ECDSA\\_SHA256](#) = 0x06000609,  
[HSM\\_SIGNATURE\\_SCHEME\\_ECDSA\\_SHA384](#) = 0x0600060A,  
[HSM\\_SIGNATURE\\_SCHEME\\_ECDSA\\_SHA512](#) = 0x0600060B }

### Functions

- [hsm\\_err\\_t hsm\\_do\\_sign](#) (hsm\_hdl\_t key\_store\_hdl, [op\\_generate\\_sign\\_args\\_t](#) \*args)
- [hsm\\_err\\_t hsm\\_open\\_signature\\_generation\\_service](#) (hsm\_hdl\_t key\_store\_hdl, [open\\_svc\\_sign\\_gen\\_args\\_t](#) \*args, hsm\_hdl\_t \*signature\_gen\_hdl)
- [hsm\\_err\\_t hsm\\_close\\_signature\\_generation\\_service](#) (hsm\_hdl\_t signature\_gen\_hdl)
- [hsm\\_err\\_t hsm\\_generate\\_signature](#) (hsm\_hdl\_t signature\_gen\_hdl, [op\\_generate\\_sign\\_args\\_t](#) \*args)
- [hsm\\_err\\_t hsm\\_prepare\\_signature](#) (hsm\_hdl\_t signature\_gen\_hdl, [op\\_prepare\\_sign\\_args\\_t](#) \*args)

#### 5.4.1 Detailed Description

#### 5.4.2 Data Structure Documentation

## Data Fields

hsm_hdl_t	signature_gen_hdl	
-----------	-------------------	--

## 5.4.2.1 struct open\_svc\_sign\_gen\_args\_t

## Data Fields

uint32_t	key_identifier	< identifier of the key to be used for the operation pointer to the input (message or message digest) to be signed
uint8_t *	message	pointer to the output area where the signature must be stored.
uint8_t *	signature	length in bytes of the output. After signature generation operation,
uint16_t	signature_size	length in bytes of the input
uint32_t	message_size	identifier of the digital signature scheme to be used
hsm_signature_scheme_id_t	scheme_id	expected signature buffer size for output, returned by FW in case
uint16_t	exp_signature_size	bitmap specifying the operation attributes
hsm_op_generate_sign_flags_t	flags	

## 5.4.2.2 struct op\_generate\_sign\_args\_t

## Data Fields

hsm_signature_scheme_id_t	scheme_id	< identifier of the digital signature scheme to be used bitmap specifying the operation attributes
hsm_op_prepare_signature_flags_t	flags	

## 5.4.2.3 struct op\_prepare\_sign\_args\_t

## 5.4.3 Macro Definition Documentation

**5.4.3.1 HSM\_OP\_GENERATE\_SIGN\_FLAGS\_INPUT\_DIGEST** `#define HSM_OP_GENERATE_SIGN_FLAGS_I↔  
NPUT_DIGEST ((hsm_op_generate_sign_flags_t) (0u << 0))`

Bit field indicating the requested operations: Bit 0:

- 0: Input is the message digest.
- 1: Input is the actual message.

## 5.4.4 Enumeration Type Documentation

### 5.4.4.1 `hsm_signature_scheme_id_t` enum `hsm_signature_scheme_id_t`

Bit field indicating the PSA compliant requested operations: Bit 2 to 7: Reserved.

## 5.4.5 Function Documentation

### 5.4.5.1 `hsm_do_sign()` `hsm_err_t` `hsm_do_sign` ( `hsm_hdl_t` `key_store_hdl`, `op_generate_sign_args_t` \* `args` )

Secondary API to generate signature on the given message.  
This API does the following:

1. Open a service flow for signature generation.
2. Based on the flag to identify the type of message: Digest or actual message, generate the signature using the key corresponding to the key id.
3. Post performing the operation, terminate the previously opened signature-generation service flow.  
User can call this function only after having opened a key-store.

#### Parameters

<code>key_store_hdl</code>	handle identifying the current key-store.
<code>args</code>	pointer to the structure containing the function arguments.

#### Returns

error code

### 5.4.5.2 `hsm_open_signature_generation_service()` `hsm_err_t` `hsm_open_signature_generation_service` ( `hsm_hdl_t` `key_store_hdl`, `open_svc_sign_gen_args_t` \* `args`, `hsm_hdl_t` \* `signature_gen_hdl` )

Open a signature generation service flow  
User can call this function only after having opened a key store service flow.

User must open this service in order to perform signature generation operations.

## Parameters

<i>key_store_hdl</i>	handle identifying the key store service flow.
<i>args</i>	pointer to the structure containing the function arguments.
<i>signature_gen_hdl</i>	pointer to where the signature generation service flow handle must be written.

## Returns

error code

**5.4.5.3 hsm\_close\_signature\_generation\_service()** `hsm_err_t hsm_close_signature_generation_↵  
service (`  
`hsm_hdl_t signature_gen_hdl )`

Terminate a previously opened signature generation service flow

## Parameters

<i>signature_gen_hdl</i>	handle identifying the signature generation service flow to be closed.
--------------------------	--

## Returns

error code

**5.4.5.4 hsm\_generate\_signature()** `hsm_err_t hsm_generate_signature (`  
`hsm_hdl_t signature_gen_hdl,`  
`op_generate_sign_args_t * args )`

Generate a digital signature according to the signature scheme User can call this function only after having opened a signature generation service flow.

The signature  $S=(r,s)$  is stored in the format  $r||s||R_y$  where:

- $R_y$  is an additional byte containing the lsb of  $y$ .  $R_y$  has to be considered valid only if the `HSM_OP_GENERATE_↵  
RATE_SIGN_FLAGS_COMPRESSED_POINT` is set.

In case of `HSM_SIGNATURE_SCHEME_DSA_SM2_FP_256_SM3`, message of `op_generate_sign_args_t` should be (as specified in GB/T 32918):

- equal to  $Z||M$  in case of `HSM_OP_GENERATE_SIGN_FLAGS_INPUT_MESSAGE`
- equal to  $SM3(Z||M)$  in case of `HSM_OP_GENERATE_SIGN_FLAGS_INPUT_DIGEST`

**Parameters**

<i>signature_gen_hdl</i>	handle identifying the signature generation service flow.
<i>args</i>	pointer to the structure containing the function arguments.

**Returns**

error code

```
5.4.5.5 hsm_prepare_signature() hsm_err_t hsm_prepare_signature (
    hsm_hdl_t signature_gen_hdl,
    op_prepare_sign_args_t * args )
```

Prepare the creation of a signature by pre-calculating the operations having not dependencies on the input message.

The pre-calculated value will be stored internally and used once call `hsm_generate_signature`. Up to 20 pre-calculated values can be stored, additional preparation operations will have no effects.

User can call this function only after having opened a signature generation service flow.

The signature  $S=(r,s)$  is stored in the format  $r||s||R_y$  where:

- $R_y$  is an additional byte containing the lsb of  $y$ ,  $R_y$  has to be considered valid only if the `HSM_OP_PREPARERE_SIGN_COMPRESSED_POINT` is set.

**Parameters**

<i>signature_gen_hdl</i>	handle identifying the signature generation service flow
<i>args</i>	pointer to the structure containing the function arguments.

**Returns**

error code

## 5.5 Signature verification

### Data Structures

- struct [open\\_svc\\_sign\\_ver\\_args\\_t](#)
- struct [op\\_verify\\_sign\\_args\\_t](#)

### Macros

- #define **HSM\_OP\_VERIFY\_SIGN\_FLAGS\_INPUT\_DIGEST** ((hsm\_op\_verify\_sign\_flags\_t)(0u << 0))
- #define **HSM\_OP\_VERIFY\_SIGN\_FLAGS\_INPUT\_MESSAGE** ((hsm\_op\_verify\_sign\_flags\_t)(1u << 0))
- #define **HSM\_OP\_VERIFY\_SIGN\_FLAGS\_COMPRESSED\_POINT** ((hsm\_op\_verify\_sign\_flags\_t)(1u << 1))  
*when set the value passed by the key argument is considered as the internal*
- #define **HSM\_OP\_VERIFY\_SIGN\_FLAGS\_KEY\_INTERNAL** ((hsm\_op\_verify\_sign\_flags\_t)(1u << 2))
- #define **HSM\_VERIFICATION\_STATUS\_SUCCESS** ((hsm\_verification\_status\_t)(0x5A3CC3A5u))
- #define **HSM\_VERIFICATION\_STATUS\_FAILURE** ((hsm\_verification\_status\_t)(0x2B4DD4B2u))

### Typedefs

- typedef uint32\_t **hsm\_verification\_status\_t**
- typedef uint8\_t **hsm\_op\_verify\_sign\_flags\_t**

### Functions

- [hsm\\_err\\_t hsm\\_verify\\_sign](#) (hsm\_hdl\_t session\_hdl, [op\\_verify\\_sign\\_args\\_t](#) \*args, hsm\_verification\_status\_t \*verification\_status)
- [hsm\\_err\\_t hsm\\_open\\_signature\\_verification\\_service](#) (hsm\_hdl\_t session\_hdl, [open\\_svc\\_sign\\_ver\\_args\\_t](#) \*args, hsm\_hdl\_t \*signature\_ver\_hdl)
- [hsm\\_err\\_t hsm\\_close\\_signature\\_verification\\_service](#) (hsm\_hdl\_t signature\_ver\_hdl)
- [hsm\\_err\\_t hsm\\_verify\\_signature](#) (hsm\_hdl\_t signature\_ver\_hdl, [op\\_verify\\_sign\\_args\\_t](#) \*args, hsm\_verification\_status\_t \*status)

#### 5.5.1 Detailed Description

#### 5.5.2 Data Structure Documentation

##### Data Fields

hsm_hdl_t	sig_ver_hdl	
-----------	-------------	--

##### 5.5.2.1 struct open\_svc\_sign\_ver\_args\_t

##### Data Fields

uint8_t *	key	< pointer to the public key to be used for the verification. pointer to the input (message or message digest)
-----------	-----	--

## Data Fields

uint8_t *	message	pointer to the input signature. The signature S=(r,s) is expected
uint8_t *	signature	length in bytes of the input key
uint16_t	key_size	length in bytes of the output - it must contain one additional
uint16_t	signature_size	length in bytes of the input message
uint32_t	message_size	
hsm_verification_status_t	verification_status	identifier of the digital signature scheme to be used
hsm_signature_scheme_id_t	scheme_id	
hsm_bit_key_sz_t	key_sz	
hsm_pubkey_type_t	pkey_type	bitmap specifying the operation attributes
hsm_op_verify_sign_flags_t	flags	

## 5.5.2.2 struct op\_verify\_sign\_args\_t

## 5.5.3 Function Documentation

**5.5.3.1 hsm\_verify\_sign()** `hsm_err_t hsm_verify_sign (`  
`hsm_hdl_t session_hdl,`  
`op_verify_sign_args_t * args,`  
`hsm_verification_status_t * verification_status )`

Secondary API to verify a message signature.

This API does the following:

1. Open a flow for verification of the signature.
2. Based on the flag to identify the type of message: Digest or actual message, verification of the signature is done using the public key.
3. Post performing the operation, terminate the previously opened signature-verification service flow.  
User can call this function only after having opened a session.

## Parameters

<i>key_store_hdl</i>	handle identifying the current key-store.
<i>args</i>	pointer to the structure containing the function arguments.

## Returns

error code

**5.5.3.2 hsm\_open\_signature\_verification\_service()** `hsm_err_t hsm_open_signature_verification_↵`  
`service (`  
     `hsm_hdl_t session_hdl,`  
     `open_svc_sign_ver_args_t * args,`  
     `hsm_hdl_t * signature_ver_hdl )`

User must open this service in order to perform signature verification operations. User can call this function only after having opened a session.

#### Parameters

<i>session_hdl</i>	handle identifying the current session.
<i>args</i>	pointer to the structure containing the function arguments.
<i>signature_ver_hdl</i>	pointer to where the signature verification service flow handle must be written.

#### Returns

error code

**5.5.3.3 hsm\_close\_signature\_verification\_service()** `hsm_err_t hsm_close_signature_verification_↵`  
`service (`  
     `hsm_hdl_t signature_ver_hdl )`

Terminate a previously opened signature verification service flow

#### Parameters

<i>signature_ver_hdl</i>	handle identifying the signature verification service flow to be closed.
--------------------------	--

#### Returns

error code

**5.5.3.4 hsm\_verify\_signature()** `hsm_err_t hsm_verify_signature (`  
     `hsm_hdl_t signature_ver_hdl,`  
     `op_verify_sign_args_t * args,`  
     `hsm_verification_status_t * status )`

Verify a digital signature according to the signature scheme User can call this function only after having opened a signature verification service flow.

The signature S=(r,s) is expected to be in format r||s||Ry where:

- Ry is an additional byte containing the lsb of y. Ry will be considered as valid only, if the HSM\_OP\_VERIFY\_↵  
Y\_SIGN\_FLAGS\_COMPRESSED\_POINT is set.



Only not-compressed keys (x,y) can be used by this command. Compressed keys can be decompressed by using the dedicated API.

In case of HSM\_SIGNATURE\_SCHEME\_DSA\_SM2\_FP\_256\_SM3, message of [op\\_verify\\_sign\\_args\\_t](#) should be (as specified in GB/T 32918):

- equal to  $Z||M$  in case of HSM\_OP\_VERIFY\_SIGN\_FLAGS\_INPUT\_MESSAGE
- equal to  $SM3(Z||M)$  in case of HSM\_OP\_VERIFY\_SIGN\_FLAGS\_INPUT\_DIGEST

#### Parameters

<i>signature_ver_hdl</i>	handle identifying the signature verification service flow.
<i>args</i>	pointer to the structure containing the function arguments.
<i>status</i>	pointer to where the verification status must be stored if the verification succeed the value HSM_VERIFICATION_STATUS_SUCCESS is returned.

#### Returns

error code

## 5.6 Random number generation

### Data Structures

- struct [op\\_get\\_random\\_args\\_t](#)

### Functions

- [hsm\\_err\\_t hsm\\_do\\_rng](#) (hsm\_hdl\_t session\_hdl, [op\\_get\\_random\\_args\\_t](#) \*args)
- [hsm\\_err\\_t hsm\\_get\\_random](#) (hsm\_hdl\_t rng\_hdl, [op\\_get\\_random\\_args\\_t](#) \*args)

#### 5.6.1 Detailed Description

#### 5.6.2 Data Structure Documentation

##### Data Fields

uint8_t *	output	pointer to the output area where the random number must be written
uint32_t	random_size	length in bytes of the random number to be provided.

##### 5.6.2.1 struct [op\\_get\\_random\\_args\\_t](#)

#### 5.6.3 Function Documentation

**5.6.3.1 [hsm\\_do\\_rng\(\)](#)** [hsm\\_err\\_t](#) hsm\_do\_rng (   
     hsm\_hdl\_t session\_hdl,   
     [op\\_get\\_random\\_args\\_t](#) \* args )

Secondary API to fetch the Random Number

This API does the following: Get a freshly generated random number

##### Parameters

<i>session_hdl</i>	handle identifying the current session.
<i>args</i>	pointer to the structure containing the function arguments.

##### Returns

error code

**5.6.3.2 hsm\_get\_random()** `hsm_err_t hsm_get_random (`  
    `hsm_hdl_t rng_hdl,`  
    `op_get_random_args_t * args )`

Get a freshly generated random number

User can call this function only after having opened a rng service flow

**Parameters**

<i>rng_hdl</i>	handle identifying the rng service flow.
<i>args</i>	pointer to the structure containing the function arguments.

**Returns**

error code

## 5.7 Hashing

### Data Structures

- struct [op\\_hash\\_one\\_go\\_args\\_t](#)

### Macros

- #define **HSM\_HASH\_FLAG\_ALLOWED**

### Enumerations

- enum **hsm\_hash\_algo\_t** {  
**HSM\_HASH\_ALGO\_SHA\_224** = 0x02000008,  
**HSM\_HASH\_ALGO\_SHA\_256** = 0x02000009,  
**HSM\_HASH\_ALGO\_SHA\_384** = 0x0200000A,  
**HSM\_HASH\_ALGO\_SHA\_512** = 0x0200000B }
- enum **hsm\_hash\_svc\_flags\_t** {  
**HSM\_HASH\_FLAG\_ONE\_SHOT** = 0x1,  
**HSM\_HASH\_FLAG\_INIT** = 0x2,  
**HSM\_HASH\_FLAG\_UPDATE** = 0x4,  
**HSM\_HASH\_FLAG\_FINAL** = 0x8,  
**HSM\_HASH\_FLAG\_GET\_CONTEXT** = 0x80 }

### Functions

- [hsm\\_err\\_t hsm\\_do\\_hash](#) (hsm\_hdl\_t session\_hdl, [op\\_hash\\_one\\_go\\_args\\_t](#) \*args)
- [hsm\\_err\\_t hsm\\_hash\\_one\\_go](#) (hsm\_hdl\_t hash\_hdl, [op\\_hash\\_one\\_go\\_args\\_t](#) \*args)

#### 5.7.1 Detailed Description

#### 5.7.2 Data Structure Documentation

##### Data Fields

uint8_t *	msb	< pointer to the MSB of address in the requester space where buffers pointer to the context.
uint8_t *	ctx	pointer to the input data to be hashed
uint8_t *	input	pointer to the output area where the resulting digest must be written
uint8_t *	output	length in bytes of the input
uint32_t	input_size	length in bytes of the output
uint32_t	output_size	hash algorithm to be used for the operation
hsm_hash_algo_t	algo	flags identifying the operation init() update(), final() or one shot
hsm_hash_svc_flags_t	svc_flags	size of context buffer in bytes, ignored in case of one shot
uint16_t	ctx_size	expected output digest buffer size, returned by FW in case the
uint32_t	exp_output_size	expected context size to allocate in bytes, if flag Get context
uint16_t	context_size	

### 5.7.2.1 struct op\_hash\_one\_go\_args\_t

## 5.7.3 Macro Definition Documentation

### 5.7.3.1 HSM\_HASH\_FLAG\_ALLOWED `#define HSM_HASH_FLAG_ALLOWED`

Value:

```
(HSM_HASH_FLAG_ONE_SHOT | HSM_HASH_FLAG_INIT \
| HSM_HASH_FLAG_UPDATE | HSM_HASH_FLAG_FINAL \
| HSM_HASH_FLAG_GET_CONTEXT)
```

## 5.7.4 Function Documentation

**5.7.4.1 hsm\_do\_hash()** `hsm_err_t hsm_do_hash (`  
    `hsm_hdl_t session_hdl,`  
    `op_hash_one_go_args_t * args )`

Secondary API to digest a message.

This API does the following: Perform hash

#### Parameters

<i>session_hdl</i>	handle identifying the current session.
<i>args</i>	pointer to the structure containing the function arguments.

#### Returns

error code

**5.7.4.2 hsm\_hash\_one\_go()** `hsm_err_t hsm_hash_one_go (`  
    `hsm_hdl_t hash_hdl,`  
    `op_hash_one_go_args_t * args )`

Perform the hash operation on a given input

User can call this function only after having opened a hash service flow

#### Parameters

<i>hash_hdl</i>	handle identifying the hash service flow.
<i>args</i>	pointer to the structure containing the function arguments.

#### Returns

error code

## 5.8 Data storage

### Data Structures

- struct [open\\_svc\\_data\\_storage\\_args\\_t](#)
- struct [op\\_data\\_storage\\_args\\_t](#)

### Macros

- #define [HSM\\_OP\\_DATA\\_STORAGE\\_FLAGS\\_STORE](#) ((hsm\_op\_data\_storage\_flags\_t)(1u << 0))  
*Store data.*
- #define [HSM\\_OP\\_DATA\\_STORAGE\\_FLAGS\\_RETRIEVE](#) ((hsm\_op\_data\_storage\_flags\_t)(0u << 0))  
*Retrieve data.*

### Typedefs

- typedef uint8\_t [hsm\\_svc\\_data\\_storage\\_flags\\_t](#)
- typedef uint8\_t [hsm\\_op\\_data\\_storage\\_flags\\_t](#)

### Functions

- [hsm\\_err\\_t hsm\\_data\\_ops](#) (hsm\_hdl\_t key\_store\_hdl, [op\\_data\\_storage\\_args\\_t](#) \*args)
- [hsm\\_err\\_t hsm\\_open\\_data\\_storage\\_service](#) (hsm\_hdl\_t key\_store\_hdl, [open\\_svc\\_data\\_storage\\_args\\_t](#) \*args, hsm\_hdl\_t \*data\_storage\_hdl)
- [hsm\\_err\\_t hsm\\_data\\_storage](#) (hsm\_hdl\_t data\_storage\_hdl, [op\\_data\\_storage\\_args\\_t](#) \*args)
- [hsm\\_err\\_t hsm\\_close\\_data\\_storage\\_service](#) (hsm\_hdl\_t data\_storage\_hdl)

#### 5.8.1 Detailed Description

#### 5.8.2 Data Structure Documentation

##### Data Fields

hsm_hdl_t	data_storage_handle	
hsm_svc_data_storage_flags_t	flags	bitmap specifying the services properties.
uint8_t	reserved[3]	

##### 5.8.2.1 struct open\_svc\_data\_storage\_args\_t

##### Data Fields

uint8_t *	data	< pointer to the data. In case of store request, length in bytes of the data
uint32_t	data_size	id of the data
uint16_t	data_id	bitmap specifying the services properties.
hsm_svc_data_storage_flags_t	flags	flags bitmap specifying the operation attributes.
hsm_op_data_storage_flags_t	svc_flags	

### 5.8.2.2 struct op\_data\_storage\_args\_t

## 5.8.3 Function Documentation

**5.8.3.1 hsm\_data\_ops()** `hsm_err_t hsm_data_ops (`  
`hsm_hdl_t key_store_hdl,`  
`op_data_storage_args_t * args )`

Secondary API to store and restore data from the linux filesystem managed by EdgeLock Enclave Firmware.

This API does the following:

1. Open an data storage service Flow
2. Based on the flag for operation attribute: Store or Re-store,
  - Store the data
  - Re-store the data, from the non-volatile storage.
3. Post performing the operation, terminate the previously opened data-storage service flow.  
 User can call this function only after having opened a key-store.

#### Parameters

<i>key_store_hdl</i>	handle identifying the current key-store.
<i>args</i>	pointer to the structure containing the function arguments.

#### Returns

error code

**5.8.3.2 hsm\_open\_data\_storage\_service()** `hsm_err_t hsm_open_data_storage_service (`  
`hsm_hdl_t key_store_hdl,`  
`open_svc_data_storage_args_t * args,`  
`hsm_hdl_t * data_storage_hdl )`

Open a data storage service flow

User must open this service flow in order to store/retrieve generic data in/from the HSM.

#### Parameters

<i>key_store_hdl</i>	handle identifying the key store service flow.
<i>args</i>	pointer to the structure containing the function arguments.
<i>data_storage_hdl</i>	pointer to where the data storage service flow handle must be written.



**Returns**

error\_code error code.

**5.8.3.3 hsm\_data\_storage()** `hsm_err_t hsm_data_storage (`  
    `hsm_hdl_t data_storage_hdl,`  
    `op_data_storage_args_t * args )`

Store or retrieve generic data identified by a data\_id.

**Parameters**

<i>data_storage_hdl</i>	handle identifying the data storage service flow.
<i>args</i>	pointer to the structure containing the function arguments.

**Returns**

error code

**5.8.3.4 hsm\_close\_data\_storage\_service()** `hsm_err_t hsm_close_data_storage_service (`  
    `hsm_hdl_t data_storage_hdl )`

Terminate a previously opened data storage service flow

**Parameters**

<i>data_storage_hdl</i>	handle identifying the data storage service flow.
-------------------------	---

**Returns**

error code

## 5.9 Authenticated Encryption

### Functions

- [hsm\\_err\\_t hsm\\_do\\_auth\\_enc](#) (hsm\_hdl\_t key\_store\_hdl, [op\\_auth\\_enc\\_args\\_t](#) \*auth\_enc\_args)

#### 5.9.1 Detailed Description

#### 5.9.2 Function Documentation

**5.9.2.1 hsm\_do\_auth\_enc()** [hsm\\_err\\_t](#) hsm\_do\_auth\_enc (   
hsm\_hdl\_t key\_store\_hdl,   
[op\\_auth\\_enc\\_args\\_t](#) \* auth\_enc\_args )

Secondary API to perform Authenticated Encryption  
This API does the following:

1. Opens Cipher Service Flow
2. Perform Authenticated Encryption operation
3. Terminates the previously opened Cipher service flow  
User can call this function only after having opened a key store service flow.

#### Parameters

<i>key_store_hdl</i>	handle identifying the key store service flow.
<i>args</i>	pointer to the structure containing the function arguments.

#### Returns

error code

## 5.10 Mac

### Data Structures

- struct [open\\_svc\\_mac\\_args\\_t](#)
- struct [op\\_mac\\_one\\_go\\_args\\_t](#)

### Macros

- `#define HSM_OP_MAC_ONE_GO_FLAGS_MAC_VERIFICATION ((hsm_op_mac_one_go_flags_t)(0u << 0))`
- `#define HSM_OP_MAC_ONE_GO_FLAGS_MAC_GENERATION ((hsm_op_mac_one_go_flags_t)(1u << 0))`
- `#define HSM_MAC_VERIFICATION_STATUS_SUCCESS ((hsm_mac_verification_status_t)(0x6C1AA1↵C6u))`

*Following three permitted algos are allowed:*

### Typedefs

- `typedef uint8_t hsm_op_mac_one_go_flags_t`
- `typedef uint32_t hsm_mac_verification_status_t`
- `typedef hsm_permitted_algo_t hsm_op_mac_one_go_algo_t`

### Functions

- `hsm_err_t hsm_do_mac` (hsm\_hdl\_t key\_store\_hdl, [op\\_mac\\_one\\_go\\_args\\_t](#) \*mac\_one\_go)
- `hsm_err_t hsm_open_mac_service` (hsm\_hdl\_t key\_store\_hdl, [open\\_svc\\_mac\\_args\\_t](#) \*args, hsm\_hdl\_t↵t \*mac\_hdl)
- `hsm_err_t hsm_mac_one_go` (hsm\_hdl\_t mac\_hdl, [op\\_mac\\_one\\_go\\_args\\_t](#) \*args, hsm\_mac\_verification↵\_status\_t \*status)
- `hsm_err_t hsm_close_mac_service` (hsm\_hdl\_t mac\_hdl)

#### 5.10.1 Detailed Description

#### 5.10.2 Data Structure Documentation

##### Data Fields

hsm_hdl_t	mac_serv_hdl	
-----------	--------------	--

##### 5.10.2.1 struct open\_svc\_mac\_args\_t

##### Data Fields

uint32_t	key_identifier	< identifier of the key to be used for the operation algorithm to be used for the operation
hsm_op_mac_one_go_algo_t	algorithm	bitmap specifying the operation attributes

## Data Fields

hsm_op_mac_one_go_flags_t	flags	pointer to the payload area
uint8_t *	payload	pointer to the tag area
uint8_t *	mac	length in bytes of the payload
uint32_t	payload_size	length of the tag.
uint16_t	mac_size	expected mac size for output, returned by FW in case the mac size
uint16_t	expected_mac_size	
hsm_mac_verification_status_t	verification_status	

## 5.10.2.2 struct op\_mac\_one\_go\_args\_t

## 5.10.3 Function Documentation

**5.10.3.1 hsm\_do\_mac()** `hsm_err_t hsm_do_mac (`  
`hsm_hdl_t key_store_hdl,`  
`op_mac_one_go_args_t * mac_one_go )`

Secondary API to perform mac operation

This API does the following:

1. Open an MAC Service Flow
2. Perform mac operation
3. Terminate a previously opened mac service flow  
 User can call this function only after having opened a key store service flow.

## Parameters

<i>key_store_hdl</i>	handle identifying the key store service flow.
<i>args</i>	pointer to the structure containing the function arguments.

## Returns

error code

**5.10.3.2 hsm\_open\_mac\_service()** `hsm_err_t hsm_open_mac_service (`  
`hsm_hdl_t key_store_hdl,`  
`open_svc_mac_args_t * args,`  
`hsm_hdl_t * mac_hdl )`

Open a mac service flow

User can call this function only after having opened a key store service flow.  
User must open this service in order to perform mac operation

#### Parameters

<i>key_store_hdl</i>	handle identifying the key store service flow.
<i>args</i>	pointer to the structure containing the function arguments.
<i>mac_hdl</i>	pointer to where the mac service flow handle must be written.

#### Returns

error code

```
5.10.3.3 hsm_mac_one_go() hsm_err_t hsm_mac_one_go (
    hsm_hdl_t mac_hdl,
    op_mac_one_go_args_t * args,
    hsm_mac_verification_status_t * status )
```

Perform mac operation

User can call this function only after having opened a mac service flow

For CMAC algorithm, a key of type HSM\_KEY\_TYPE\_AES\_XXX must be used

For HMAC algorithm, a key of type HSM\_KEY\_TYPE\_HMAC\_XXX must be used

For mac verification operations, the verified mac length can be specified in:

- Bits by setting the HSM\_OP\_MAC\_ONE\_GO\_FLAGS\_MAC\_LENGTH\_IN\_BITS flag,
- if this flag is clear then the mac\_length is specified in bytes.

For mac generation operations:

- mac length must be set in bytes, and
- HSM\_OP\_MAC\_ONE\_GO\_FLAGS\_MAC\_LENGTH\_IN\_BITS flag must be 0

#### Parameters

<i>mac_hdl</i>	handle identifying the mac service flow.
<i>args</i>	pointer to the structure containing the function arguments.

#### Returns

error code

**5.10.3.4 hsm\_close\_mac\_service()** `hsm_err_t hsm_close_mac_service (`  
`hsm_hdl_t mac_hdl )`

Terminate a previously opened mac service flow

**Parameters**

<i>mac_hdl</i>	pointer to handle identifying the mac service flow to be closed.
----------------	--

**Returns**

error code

## 5.11 Dump Firmware Log

### Data Structures

- struct [op\\_debug\\_dump\\_args\\_t](#)

### Functions

- [hsm\\_err\\_t](#) **dump\_firmware\_log** (hsm\_hdl\_t session\_hdl)

#### 5.11.1 Detailed Description

#### 5.11.2 Data Structure Documentation

##### Data Fields

bool	is_dump_pending	
uint32_t	dump_buf_len	
uint32_t	dump_buf[MAC_BUFF_LEN]	

##### 5.11.2.1 struct op\_debug\_dump\_args\_t

## 5.12 Dev attest

### Data Structures

- struct [op\\_dev\\_attest\\_args\\_t](#)

### Functions

- [hsm\\_err\\_t hsm\\_dev\\_attest](#) (hsm\_hdl\_t sess\_hdl, [op\\_dev\\_attest\\_args\\_t](#) \*args)

#### 5.12.1 Detailed Description

#### 5.12.2 Data Structure Documentation

##### Data Fields

uint16_t	soc_id	
uint16_t	soc_rev	
uint16_t	lmda_val	
uint8_t	ssm_state	
uint8_t	uid_sz	
uint8_t *	uid	
uint16_t	rom_patch_sha_sz	
uint16_t	sha_fw_sz	
uint8_t *	sha_rom_patch	
uint8_t *	sha_fw	
uint32_t	nounce	
uint32_t	rsp_nounce	
uint8_t	attest_result	
uint8_t	reserved	
uint16_t	sign_sz	
uint8_t *	signature	

##### 5.12.2.1 struct op\_dev\_attest\_args\_t

#### 5.12.3 Function Documentation

**5.12.3.1 hsm\_dev\_attest()** [hsm\\_err\\_t](#) hsm\_dev\_attest (   
     [hsm\\_hdl\\_t](#) sess\_hdl,   
     [op\\_dev\\_attest\\_args\\_t](#) \* args )

Perform device attestation operation

User can call this function only after having opened the session.



**Parameters**

<i>sess_hdl</i>	handle identifying the active session.
<i>args</i>	pointer to the structure containing the function arguments.

**Returns**

error code

## 5.13 Dev Info

### Data Structures

- struct [op\\_dev\\_getinfo\\_args\\_t](#)

### Functions

- [hsm\\_err\\_t hsm\\_dev\\_getinfo](#) (hsm\_hdl\_t sess\_hdl, [op\\_dev\\_getinfo\\_args\\_t](#) \*args)

#### 5.13.1 Detailed Description

#### 5.13.2 Data Structure Documentation

##### Data Fields

uint16_t	soc_id	
uint16_t	soc_rev	
uint16_t	lmda_val	
uint8_t	ssm_state	
uint8_t	uid_sz	
uint8_t *	uid	
uint16_t	rom_patch_sha_sz	
uint16_t	sha_fw_sz	
uint8_t *	sha_rom_patch	
uint8_t *	sha_fw	
uint16_t	oem_srkh_sz	
uint8_t *	oem_srkh	
uint8_t	imem_state	
uint8_t	csal_state	
uint8_t	trng_state	

##### 5.13.2.1 struct op\_dev\_getinfo\_args\_t

#### 5.13.3 Function Documentation

**5.13.3.1 hsm\_dev\_getinfo()** [hsm\\_err\\_t](#) hsm\_dev\_getinfo (   
     hsm\_hdl\_t sess\_hdl,   
     [op\\_dev\\_getinfo\\_args\\_t](#) \* args )

Perform device attestation operation

User can call this function only after having opened the session.

##### Parameters

<i>sess_hdl</i>	handle identifying the active session.
<i>args</i>	pointer to the structure containing the function arguments.

**Returns**

error code

## 5.14 Generic Crypto: Asymmetric Crypto

### Data Structures

- struct [op\\_gc\\_acrypto\\_args\\_t](#)

### Macros

- #define **HSM\_OP\_GC\_ACRYPTO\_FLAGS\_INPUT\_MESSAGE** ((hsm\_op\_gc\_acrypto\_flags\_t)(1u << 0))
- #define **HSM\_GC\_ACRYPTO\_VERIFICATION\_SUCCESS** ((hsm\_gc\_acrypto\_verification\_status\_t)(0x5↵A3CC3A5u))
- #define **HSM\_GC\_ACRYPTO\_VERIFICATION\_FAILURE** ((hsm\_gc\_acrypto\_verification\_status\_t)(0x2↵B4DD4B2u))

### Typedefs

- typedef uint8\_t **hsm\_op\_gc\_acrypto\_flags\_t**
- typedef uint32\_t **hsm\_gc\_acrypto\_verification\_status\_t**

### Enumerations

- enum [hsm\\_op\\_gc\\_acrypto\\_algo\\_t](#) {  
**HSM\_GC\_ACRYPTO\_ALGO\_ECDSA\_SHA224** = ALGO\_ECDSA\_SHA224,  
**HSM\_GC\_ACRYPTO\_ALGO\_ECDSA\_SHA256** = ALGO\_ECDSA\_SHA256,  
**HSM\_GC\_ACRYPTO\_ALGO\_ECDSA\_SHA384** = ALGO\_ECDSA\_SHA384,  
**HSM\_GC\_ACRYPTO\_ALGO\_ECDSA\_SHA512** = ALGO\_ECDSA\_SHA512,  
**HSM\_GC\_ACRYPTO\_ALGO\_RSA\_PKCS1\_V15\_SHA224** = ALGO\_RSA\_PKCS1\_V15\_SHA224,  
**HSM\_GC\_ACRYPTO\_ALGO\_RSA\_PKCS1\_V15\_SHA256** = ALGO\_RSA\_PKCS1\_V15\_SHA256,  
**HSM\_GC\_ACRYPTO\_ALGO\_RSA\_PKCS1\_V15\_SHA384** = ALGO\_RSA\_PKCS1\_V15\_SHA384,  
**HSM\_GC\_ACRYPTO\_ALGO\_RSA\_PKCS1\_V15\_SHA512** = ALGO\_RSA\_PKCS1\_V15\_SHA512,  
**HSM\_GC\_ACRYPTO\_ALGO\_RSA\_PKCS1\_PSS\_MGF1\_SHA224** = ALGO\_RSA\_PKCS1\_PSS\_MGF1\_↵  
SHA224,  
**HSM\_GC\_ACRYPTO\_ALGO\_RSA\_PKCS1\_PSS\_MGF1\_SHA256** = ALGO\_RSA\_PKCS1\_PSS\_MGF1\_↵  
SHA256,  
**HSM\_GC\_ACRYPTO\_ALGO\_RSA\_PKCS1\_PSS\_MGF1\_SHA384** = ALGO\_RSA\_PKCS1\_PSS\_MGF1\_↵  
SHA384,  
**HSM\_GC\_ACRYPTO\_ALGO\_RSA\_PKCS1\_PSS\_MGF1\_SHA512** = ALGO\_RSA\_PKCS1\_PSS\_MGF1\_↵  
SHA512,  
**HSM\_GC\_ACRYPTO\_ALGO\_RSA\_PKCS1\_V15\_CRYPT** = ALGO\_RSA\_PKCS1\_V15\_CRYPT,  
**HSM\_GC\_ACRYPTO\_ALGO\_RSA\_PKCS1\_OAEP\_SHA1** = ALGO\_RSA\_PKCS1\_OAEP\_SHA1,  
**HSM\_GC\_ACRYPTO\_ALGO\_RSA\_PKCS1\_OAEP\_SHA224** = ALGO\_RSA\_PKCS1\_OAEP\_SHA224,  
**HSM\_GC\_ACRYPTO\_ALGO\_RSA\_PKCS1\_OAEP\_SHA256** = ALGO\_RSA\_PKCS1\_OAEP\_SHA256,  
**HSM\_GC\_ACRYPTO\_ALGO\_RSA\_PKCS1\_OAEP\_SHA384** = ALGO\_RSA\_PKCS1\_OAEP\_SHA384,  
**HSM\_GC\_ACRYPTO\_ALGO\_RSA\_PKCS1\_OAEP\_SHA512** = ALGO\_RSA\_PKCS1\_OAEP\_SHA512 }  
*< Algorithms to be used for the operations*
- enum **hsm\_gc\_acrypto\_op\_mode\_t** {  
**HSM\_GC\_ACRYPTO\_OP\_MODE\_ENCRYPT** = 0x01,  
**HSM\_GC\_ACRYPTO\_OP\_MODE\_DECRYPT** = 0x02,  
**HSM\_GC\_ACRYPTO\_OP\_MODE\_SIGN\_GEN** = 0x03,  
**HSM\_GC\_ACRYPTO\_OP\_MODE\_SIGN\_VER** = 0x04 }

### Functions

- [hsm\\_err\\_t hsm\\_gc\\_acrypto](#) (hsm\_hdl\_t session\_hdl, [op\\_gc\\_acrypto\\_args\\_t](#) \*args)

#### **5.14.1 Detailed Description**

#### **5.14.2 Data Structure Documentation**

## Data Fields

<code>hsm_op_gc_acrypto_algo_t</code>	algorithm	< algorithm to use for the operation indicates the operation mode
<code>hsm_gc_acrypto_op_mode_t</code>	op_mode	indicates operation flags
<code>hsm_op_gc_acrypto_flags_t</code>	flags	key size in bits
<code>hsm_bit_key_sz_t</code>	bit_key_sz	pointer to the data buffer 1:
<code>uint8_t *</code>	data_buff1	pointer to the data buffer 2:
<code>uint8_t *</code>	data_buff2	size in bytes of data buffer 1
<code>uint32_t</code>	data_buff1_size	size in bytes of data buffer 2
<code>uint32_t</code>	data_buff2_size	pointer to the key modulus buffer
<code>uint8_t *</code>	key_buff1	pointer the key exponent, either private or public
<code>uint8_t *</code>	key_buff2	size in bytes of the key buffer 1
<code>uint16_t</code>	key_buff1_size	size in bytes of the key buffer 2
<code>uint16_t</code>	key_buff2_size	RSA label address.
<code>uint8_t *</code>	rsa_label	RSA label size in bytes.
<code>uint16_t</code>	rsa_label_size	RSA salt length in bytes.
<code>uint16_t</code>	rsa_salt_len	expected plaintext length in bytes, returned by FW in case of
<code>uint32_t</code>	exp_plaintext_len	signature verification status
<code>hsm_gc_acrypto_verification_status_t</code>	verification_status	

## 5.14.2.1 struct op\_gc\_acrypto\_args\_t

## 5.14.3 Function Documentation

**5.14.3.1 hsm\_gc\_acrypto()** `hsm_err_t hsm_gc_acrypto (`  
`hsm_hdl_t session_hdl,`  
`op_gc_acrypto_args_t * args )`

This command is designed to perform the following operations: -Asymmetric crypto -encryption/decryption -signature generation/verification

## Parameters

<code>session_hdl</code>	handle identifying the current session.
<code>args</code>	pointer to the structure containing the function arguments.

## Returns

error code

## 5.15 Generic Crypto Asymmetric Key Generate

### Data Structures

- struct [op\\_gc\\_akey\\_gen\\_args\\_t](#)

### Functions

- [hsm\\_err\\_t hsm\\_gc\\_akey\\_gen](#) ([hsm\\_hdl\\_t](#) session\_hdl, [op\\_gc\\_akey\\_gen\\_args\\_t](#) \*args)

#### 5.15.1 Detailed Description

#### 5.15.2 Data Structure Documentation

##### Data Fields

<a href="#">uint8_t *</a>	modulus	< pointer to the output buffer of key modulus pointer to the output buffer of key private exponent
<a href="#">uint8_t *</a>	priv_buff	pointer to the input buffer containing key public exponent
<a href="#">uint8_t *</a>	pub_buff	size in bytes of the modulus buffer
<a href="#">uint16_t</a>	modulus_size	size in bytes of the private exponent buffer
<a href="#">uint16_t</a>	priv_buff_size	size in bytes of the public exponent buffer
<a href="#">uint16_t</a>	pub_buff_size	indicates which type of keypair must be generated
<a href="#">hsm_key_type_t</a>	key_type	size in bits of the keypair to be generated
<a href="#">hsm_bit_key_sz_t</a>	bit_key_sz	

##### 5.15.2.1 struct op\_gc\_akey\_gen\_args\_t

#### 5.15.3 Function Documentation

**5.15.3.1 hsm\_gc\_akey\_gen()** [hsm\\_err\\_t](#) hsm\_gc\_akey\_gen (   
[hsm\\_hdl\\_t](#) session\_hdl,   
[op\\_gc\\_akey\\_gen\\_args\\_t](#) \* args )

This command is designed to perform the following operations: -Generate asymmetric keys, without using FW keystore

##### Parameters

<i>session_hdl</i>	handle identifying the current session.
<i>args</i>	pointer to the structure containing the function arguments.

**Returns**

error code



## 5.16 Get Info

### Data Structures

- struct [op\\_get\\_info\\_args\\_t](#)

### Functions

- [hsm\\_err\\_t hsm\\_get\\_info](#) (hsm\_hdl\_t sess\_hdl, [op\\_get\\_info\\_args\\_t](#) \*args)

#### 5.16.1 Detailed Description

#### 5.16.2 Data Structure Documentation

##### Data Fields

uint32_t	user_sab_id	< Stores User identifier (32bits) Stores the chip unique identifier
uint8_t *	chip_unique_id	Size of the chip unique identifier in bytes.
uint16_t	chip_unq_id_sz	Stores the chip monotonic counter value (16bits)
uint16_t	chip_monotonic_counter	Stores the chip current life cycle bitfield (16bits)
uint16_t	chip_life_cycle	Stores the module version (32bits)
uint32_t	version	Stores the module extended version (32bits)
uint32_t	version_ext	Stores the FIPS mode bitfield (8bits). Bitmask definition: bit0 - FIPS mode of operation: <ul style="list-style-type: none"><li>• value 0 - part is running in FIPS non-approved mode.</li><li>• value 1 - part is running in FIPS approved mode.</li></ul> bit1 - FIPS certified part: <ul style="list-style-type: none"><li>• value 0 - part is not FIPS certified.</li><li>• value 1 - part is FIPS certified.</li></ul> bit2-7: reserved <ul style="list-style-type: none"><li>• value 0.</li></ul>
uint8_t	fips_mode	

##### 5.16.2.1 struct op\_get\_info\_args\_t

#### 5.16.3 Function Documentation

**5.16.3.1 hsm\_get\_info()** `hsm_err_t` hsm\_get\_info (   
 `hsm_hdl_t` *sess\_hdl*,   
 `op_get_info_args_t` \* *args* )

Perform device attestation operation

User can call this function only after having opened the session.

#### Parameters

<i>sess_hdl</i>	handle identifying the active session.
<i>args</i>	pointer to the structure containing the function arguments.

#### Returns

error code

## 5.17 Public key recovery

Public Key Recovery is now also known as Public Key Exportation, in PSA compliant APIs. The naming here has been kept unchanged, for backward compatibility and Non-PSA compliant APIs.

### Data Structures

- struct [op\\_pub\\_key\\_recovery\\_args\\_t](#)

### Typedefs

- typedef uint8\_t [hsm\\_op\\_pub\\_key\\_recovery\\_flags\\_t](#)

### Functions

- [hsm\\_err\\_t hsm\\_pub\\_key\\_recovery](#) (hsm\_hdl\_t key\_store\_hdl, [op\\_pub\\_key\\_recovery\\_args\\_t](#) \*args)

#### 5.17.1 Detailed Description

Public Key Recovery is now also known as Public Key Exportation, in PSA compliant APIs. The naming here has been kept unchanged, for backward compatibility and Non-PSA compliant APIs.

#### 5.17.2 Data Structure Documentation

##### Data Fields

uint32_t	key_identifier	< pointer to the identifier of the key to be used for the operation pointer to the output area where the generated public key must be written
uint8_t *	out_key	length in bytes of the output key
uint16_t	out_key_size	

##### 5.17.2.1 struct op\_pub\_key\_recovery\_args\_t

#### 5.17.3 Function Documentation

**5.17.3.1 hsm\_pub\_key\_recovery()** [hsm\\_err\\_t hsm\\_pub\\_key\\_recovery](#) (  
[hsm\\_hdl\\_t key\\_store\\_hdl](#),  
[op\\_pub\\_key\\_recovery\\_args\\_t](#) \* args )

Recover Public key from private key present in key store  
 User can call this function only after having opened a key store.

## Parameters

<i>key_store_hdl</i>	handle identifying the current key store.
<i>args</i>	pointer to the structure containing the function arguments.

## Returns

error code

## 5.18 Key store

User must open a key store service flow in order to perform the following operations:

### Data Structures

- struct [open\\_svc\\_key\\_store\\_args\\_t](#)

### Macros

- #define [HSM\\_SVC\\_KEY\\_STORE\\_FLAGS\\_LOAD](#) ((hsm\_svc\_key\_store\_flags\_t)(0u << 0))  
*It must be specified to create a new key store. The key store will be.*
- #define [HSM\\_SVC\\_KEY\\_STORE\\_FLAGS\\_CREATE](#) ((hsm\_svc\_key\_store\_flags\_t)(1u << 0))  
*If set, minimum mac length specified in min\_mac\_length field will be.*
- #define [HSM\\_SVC\\_KEY\\_STORE\\_FLAGS\\_SET\\_MAC\\_LEN](#) ((hsm\_svc\_key\_store\_flags\_t)(1u << 3))  
*The request is completed only when the new key store has been written in.*
- #define [HSM\\_SVC\\_KEY\\_STORE\\_FLAGS\\_STRICT\\_OPERATION](#) ((hsm\_svc\_key\_store\_flags\_t)(1u << 7))

### Typedefs

- typedef uint8\_t [hsm\\_svc\\_key\\_store\\_flags\\_t](#)  
*It must be specified to load a previously created key store.*

### Functions

- [hsm\\_err\\_t hsm\\_open\\_key\\_store\\_service](#) (hsm\_hdl\_t session\_hdl, [open\\_svc\\_key\\_store\\_args\\_t](#) \*args, hsm\_hdl\_t \*key\_store\_hdl)
- [hsm\\_err\\_t hsm\\_close\\_key\\_store\\_service](#) (hsm\_hdl\_t key\_store\_hdl)

#### 5.18.1 Detailed Description

User must open a key store service flow in order to perform the following operations:

- create a new key store
- perform operations involving keys stored in the key store (ciphering, signature generation...)
- perform a key store reprovisioning using a signed message. A key store re-provisioning results in erasing all the key stores handled by the HSM.

To grant access to the key store, the caller is authenticated against the domain ID (DID) and Messaging Unit used at the keystore creation, additionally an authentication nonce can be provided.

#### 5.18.2 Data Structure Documentation

## Data Fields

<code>hsm_hdl_t</code>	<code>key_store_hdl</code>	< handle identifying the key store service flow user defined id identifying the key store.
<code>uint32_t</code>	<code>key_store_identifier</code>	user defined nonce used as authentication proof for accessing the
<code>uint32_t</code>	<code>authentication_nonce</code>	maximum number of updates authorized for the key store.
<code>uint16_t</code>	<code>max_updates_number</code>	bitmap specifying the services properties.
<code>hsm_svc_key_store_flags_t</code>	<code>flags</code>	pointer to <code>signed_message</code> to be sent only in case of
<code>uint8_t *</code>	<code>signed_message</code>	size of the <code>signed_message</code> to be sent only in case of
<code>uint16_t</code>	<code>signed_msg_size</code>	

5.18.2.1 struct `open_svc_key_store_args_t`

## 5.18.3 Function Documentation

**5.18.3.1 `hsm_open_key_store_service()`** `hsm_err_t` `hsm_open_key_store_service` (  
`hsm_hdl_t session_hdl`,  
`open_svc_key_store_args_t * args`,  
`hsm_hdl_t * key_store_hdl` )

Open a service flow on the specified key store. Only one key store service can be opened on a given key store.

## Parameters

<code>session_hdl</code>	pointer to the handle identifying the current session.
<code>args</code>	pointer to the structure containing the function arguments.
<code>key_store_hdl</code>	pointer to where the key store service flow handle must be written.

## Returns

`error_code` error code.

**5.18.3.2 `hsm_close_key_store_service()`** `hsm_err_t` `hsm_close_key_store_service` (  
`hsm_hdl_t key_store_hdl` )

Close a previously opened key store service flow. The key store is deleted from the HSM local memory, any update not written in the NVM is lost

## Parameters

<code>handle</code>	identifying the key store service flow to be closed.
---------------------	--

**Returns**

`error_code` error code.

## 5.19 LC update

### Data Structures

- struct [op\\_lc\\_update\\_msg\\_args\\_t](#)

### Enumerations

- enum `hsm_lc_new_state_t` {  
    **HSM\_NXP\_PROVISIONED\_STATE** = (1u << 0),  
    **HSM\_OEM\_OPEN\_STATE** = (1u << 1),  
    **HSM\_OEM\_CLOSE\_STATE** = (1u << 3),  
    **HSM\_OEM\_FIELD\_RET\_STATE** = (1u << 4),  
    **HSM\_NXP\_FIELD\_RET\_STATE** = (1u << 5),  
    **HSM\_OEM\_LOCKED\_STATE** = (1u << 7) }

### Functions

- [hsm\\_err\\_t](#) **hsm\_lc\_update** (hsm\_hdl\_t session\_hdl, [op\\_lc\\_update\\_msg\\_args\\_t](#) \*args)

#### 5.19.1 Detailed Description

#### 5.19.2 Data Structure Documentation

##### Data Fields

<code>hsm_lc_new_state_t</code>	<code>new_lc_state</code>	
---------------------------------	---------------------------	--

##### 5.19.2.1 struct `op_lc_update_msg_args_t`



## 5.20 Error codes

### Enumerations

```

• enum hsm_err_t {
    HSM_NO_ERROR = 0x0,
    HSM_INVALID_MESSAGE = 0x1,
    HSM_INVALID_ADDRESS = 0x2,
    HSM_UNKNOWN_ID = 0x3,
    HSM_INVALID_PARAM = 0x4,
    HSM_NVM_ERROR = 0x5,
    HSM_OUT_OF_MEMORY = 0x6,
    HSM_UNKNOWN_HANDLE = 0x7,
    HSM_UNKNOWN_KEY_STORE = 0x8,
    HSM_KEY_STORE_AUTH = 0x9,
    HSM_KEY_STORE_ERROR = 0xA,
    HSM_ID_CONFLICT = 0xB,
    HSM_RNG_NOT_STARTED = 0xC,
    HSM_CMD_NOT_SUPPORTED = 0xD,
    HSM_INVALID_LIFECYCLE = 0xE,
    HSM_KEY_STORE_CONFLICT = 0xF,
    HSM_KEY_STORE_COUNTER = 0x10,
    HSM_FEATURE_NOT_SUPPORTED = 0x11,
    HSM_SELF_TEST_FAILURE = 0x12,
    HSM_NOT_READY_RATING = 0x13,
    HSM_FEATURE_DISABLED = 0x14,
    HSM_KEY_GROUP_FULL = 0x19,
    HSM_CANNOT_RETRIEVE_KEY_GROUP = 0x1A,
    HSM_KEY_NOT_SUPPORTED = 0x1B,
    HSM_CANNOT_DELETE_PERMANENT_KEY = 0x1C,
    HSM_OUT_TOO_SMALL = 0x1D,
    HSM_CRC_CHECK_ERR = 0xB9,
    HSM_OEM_CLOSED_LC_SIGNED_MSG_VERIFICATION_FAIL = 0xF0,
    HSM_OEM_OPEN_LC_SIGNED_MSG_VERIFICATION_FAIL = 0xF0,
    HSM_FATAL_FAILURE = 0x29,
    HSM_SERVICES_DISABLED = 0xF4,
    HSM_UNKNOWN_WARNING = 0xFC,
    HSM_SIGNATURE_INVALID = 0xFD,
    HSM_UNKNOWN_ERROR = 0xFE,
    HSM_GENERAL_ERROR = 0xFF }

```

### 5.20.1 Detailed Description

### 5.20.2 Enumeration Type Documentation

#### 5.20.2.1 hsm\_err\_t enum hsm\_err\_t

Error codes returned by HSM functions.

##### Enumerator

HSM_NO_ERROR	Success. The received message is invalid or unknown.
--------------	--

## Enumerator

HSM_INVALID_MESSAGE	The provided address is invalid or doesn't respect the API requirements.
HSM_INVALID_ADDRESS	The provided identifier is not known.
HSM_UNKNOWN_ID	One of the parameter provided in the command is invalid.
HSM_INVALID_PARAM	NVM generic issue.
HSM_NVM_ERROR	There is not enough memory to handle the requested operation.
HSM_OUT_OF_MEMORY	Unknown session/service handle.
HSM_UNKNOWN_HANDLE	The key store identified by the provided "key store Id" doesn't exist and the "create" flag is not set.
HSM_UNKNOWN_KEY_STORE	Key store authentication fails.
HSM_KEY_STORE_AUTH	An error occurred in the key store internal processing.
HSM_KEY_STORE_ERROR	An element (key store, key. . .) with the provided ID already exists.
HSM_ID_CONFLICT	The internal RNG is not started.
HSM_RNG_NOT_STARTED	The functionality is not supported for the current session/service/key store configuration.
HSM_CMD_NOT_SUPPORTED	Invalid lifecycle for requested operation.
HSM_INVALID_LIFECYCLE	A key store with the same attributes already exists.
HSM_KEY_STORE_CONFLICT	The current key store reaches the max number of monotonic counter updates, updates are still allowed but monotonic counter will not be blown.
HSM_KEY_STORE_COUNTER	The requested feature is not supported by the firmware.
HSM_FEATURE_NOT_SUPPORTED	Self tests report an issue
HSM_SELF_TEST_FAILURE	The HSM is not ready to handle the current request
HSM_NOT_READY_RATING	The required service/operation is disabled
HSM_FEATURE_DISABLED	Not enough space to store the key in the key group
HSM_KEY_GROUP_FULL	Impossible to retrieve key group
HSM_CANNOT_RETRIEVE_KEY_GROUP	Key not supported
HSM_KEY_NOT_SUPPORTED	Trying to delete a permanent key
HSM_CANNOT_DELETE_PERMANENT_KEY	Output buffer size is too small
HSM_OUT_TOO_SMALL	Command CRC check error
HSM_CRC_CHECK_ERR	In OEM closed lifecycle, Signed message signature verification failure
HSM_OEM_CLOSED_LC_SIGNED_MSG_VERIFICATION_FAIL	Warning: In OEM open lifecycles, Signed message signature verification failure
HSM_OEM_OPEN_LC_SIGNED_MSG_VERIFICATION_FAIL	A fatal failure occurred, the HSM goes in unrecoverable error state not replying to further requests
HSM_FATAL_FAILURE	Message neither handled by ROM nor FW
HSM_SERVICES_DISABLED	Unknown warnings
HSM_UNKNOWN_WARNING	Failure in verification status of operations such as MAC verification, Signature verification.
HSM_SIGNATURE_INVALID	Unknown errors
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